T100 or 101-250. “Fast” or “slow” achieving T100 players were determined according to the years taken to achieve a professional T100 status. International tournament and match volumes were quantified for junior and professional categories, along with tournament distribution (i.e., days between tournaments and consecutive tournaments). Three categories of junior tournaments were defined alongside four categories of professional events. A two-way (age x ranking group) analysis of variance (ANOVA) determined the effects of respective age (13-18y) and ranking group (T100 vs. T250) on competition engagement metrics.

Results: Significant interaction effects for age and ranking group were observed for all junior and professional category tournaments ($p<0.05$). Significantly higher junior tournament volumes existed for T100 compared to T250 players at ages 14 and 15 ($p<0.05$), with greater professional tournament volumes at ages 17 and 18 ($p<0.05$). Significant interaction effects for match volumes showed higher engagement from T100 compared to T250 players at ages 14-16y ($p<0.05$). Overall match counts peaked in mid-late adolescence (i.e., 16-18y) and ranged from ≈80-110 annual matches. Significant main effects for age revealed decreased days between tournaments and increased consecutive tournaments at 15y ($p<0.05$). Specifically, an average of <3 weeks existed between tournament exposures during late adolescence.

Discussion: Accordingly, increased volume and density of tournament-play exists from age 14y in future professional female tennis players. This would likely restrict opportunities for increased dedicated training loads as recommended in holistic athlete development pathways. Further, faster achieving T100 players contest higher-quality junior and professional tournaments at earlier ages. These distinctive tournament characteristics can underpin elite pathway scheduling recommendations provided by many national tennis federations. Specifically, improvements to competition pathways for elite players may exist through these understandings of “fast” and “slow” developing T100 tennis players.

Impact and Application to the Field

- Competition schedules can be used in combination with ranking milestones to inform player selection strategies and funding from national Federations.
- Focused training exposures within the athlete development matrix from tennis Federations can be explicitly provided alongside recommended tournament periodisation that is conducive to future success.

Conflict of Interest Statement: Four of the five authors are currently employed by Tennis Australia.

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(P100108)

Determining stroke and movement profiles in competitive tennis match-play from wearable sensor accelerometry

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Introduction: The external load profile of tennis consists of repeated hitting and running actions, though appropriate technology to capture these concurrent demands are limited. Recent innovations in commercial wearable technology have revealed tennis-specific algorithms are able to detect forehand, backhand and serve stroke events alongside traditional movement metrics. Consequently, this study determined stroke and movement accelerometry metrics from a wearable sensor and compared between court surface (grass vs. hard) and match outcome (win vs. loss) during competitive tennis match-play.

Methods: Eight junior high-performance tennis players wore a trunk-mounted GPS, with in-built accelerometer, magnetometer and gyroscope during singles matches on hard and grass courts. Manufacturer software calculated accelerometer-derived total Player Load (tPL). A prototype algorithm classified forehands, backhands, serves and “other” strokes, thereby calculating stroke player load (sPL) from individual strokes. Movement player load (mPL) was calculated as the difference between tPL and sPL, with all metrics reported as absolute and relative ($\cdot min^{-1}$, %, $\cdot$ stroke). Analysis of accelerometer load and stroke count metrics were performed via a two-way (surface [grass vs. hard] x match outcome [win vs. loss]) ANOVA ($p < 0.05$) and effect sizes (Cohen’s d).

Results: Respective mPL and sPL were reported at 431 ±185 and 116 ±55 arbitrary units (AU) during typical hard court match-play. No interaction effects for surface and match outcome existed for absolute tPL, mPL and sPL ($p>0.05$). Increased mPL% featured on grass courts compared to hard courts (83 ±2) vs. 79 ±5), while sPL% was increased on hard courts ($p=0.04$, $d=1.18$[0.31-2.02]). Elevated $sPL\cdot min^{-1}$ existed on hard courts ($p=0.04$, $d=1.19$[0.32-2.04]), but no differences in $tPL\cdot min^{-1}$ and $mPL\cdot min^{-1}$ were evident for surface or outcome ($p>0.05$). Relative forehand sPL ($FH\text{-}sPL\cdot min^{-1}$) was higher on hard courts ($p=0.03$, $d=1.18$[0.31-2.02]) alongside higher forehand counts ($p=0.01$, $d=1.29$ [0.40-2.14).

Discussion: Hitting demands are heightened on hard courts from increased sPL and stroke counts. Conversely, increased mPL% on grass courts likely reflect the specific movement demands from point-play. In combination, these findings suggest that grouping the physical demands of hard and grass courts are likely inappropriate. Physical preparation strategies during training blocks can be tailored towards movement or hitting loads to suit competitive surfaces. Within grass court tournament blocks, detraining effects due to match-play exposures may be heightened due to lower time spent in point-play (i.e., reduced $sPL\cdot min^{-1}$) and could require supplementary drills from conditioning staff to mitigate this occurrence. Lastly, technical coaches can utilise stroke count measures to improve understandings of hitting load exposures across stroke type during competitive periods.

Impact and Application to the Field

- For sport science practitioners, load monitoring surveillance via accelerometry measures can be confidently implemented during training blocks given the sensitivity of sPL to court surface changes, which is reflective of different stroke types used and overall hitting volumes.
- Strength and conditioning staff working in tennis can maximise available training block time in targeting movement- or stroke-specific physical adaptations dependant on the competitive surface.

Conflict of Interest Statement: Three of the five authors are currently employed by Tennis Australia and one author is employed by Catapult Sports.

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(P100109)

The use of physical function capacity measures in the management of lower limb tendinopathy: A scoping review of expert recommendations

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Introduction: hysical function capacity measures are recommended as outcomes in people with lower limb tendinopathy, however, a recent systematic review reported that they are rarely used. The purpose of this scoping review was to explore the measures of physical function capacity and the context in which they were used as recommended by experts in lower limb tendinopathy.

Methods: Databases including Medline, Embase and CINAHL were searched using keywords related to lower limb tendinopathy and physical function capacity from inception to May 2022. Eligibility criteria included expert opinion papers, clinical commentaries, and narrative reviews that outlined a rehabilitation protocol. Systematic reviews and trials were excluded. Study selection was limited to sources which included a progressive exercise protocol for adults with lower limb tendinopathy. Following selection, a 15-item tool was used for data extraction, and data reported descriptively.

Results: Of the 26 studies included, only 8 recommended a physical function capacity measure. There were 10 physical function capacity measures across three domains including: (i) strength (isometric strength, repetition maximum and two variations of the heel raise test), (ii) power (hop and jump tests), and (iii) balance (single leg stance). These measures were included in sources across a range of lower limb tendinopathies ((patellar (4/10), Achilles (1/10), proximal hamstring (1/10), gluteal (1/10), combined patellar and Achilles (1/10)). Most physical function capacity measures were recommended for Achilles or patellar tendinopathy (9/10), with hop and jump tests the most frequently included (5/10). Progression criteria were recorded in all 26/26 of studies. Pain was the most common criterion that was used to determine the progression of rehabilitation (25/26 studies) with physical function capacity measures used rarely as criterion (3/26 studies).

Conclusion: Physical function capacity measures are infrequently documented and their use is inconsistent across a variety of expert recommended rehabilitation programs. This may be due to the limited evidence available to guide the appropriate use of measures and the interpretation of measures in the context of lower limb tendinopathy. Due to the limited use of measures, there is a need to develop tests of physical function capacity for patients with lower limb tendinopathy that can better guide functional improvements in addition to pain, to improve exercise rehabilitation outcomes.

Impact/Application to the field:

- Of the limited number of physical function capacity measures recommended by experts in lower limb tendinopathy, very few are used as progression criteria in exercise rehabilitation.
- The hop and jump tests which are the most commonly recommended physical function capacity measures by experts require greater empirical evidence to justify their use in clinical practice.

Conflict of interest statement: my co-authors and I acknowledge that we have no conflict interest of relevance to the submission of this abstract.

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(P100110)

Is running good or bad for your knees and hips? A systematic review and meta-analysis

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Introduction: Running is a popular physical activity but associated with high rates of musculoskeletal injury. Running is perceived by some to be detrimental to joint health, yet it does not seem to increase the risk of knee or hip osteoarthritis (OA) or accelerate OA progression. Cartilage loss is the hallmark feature of OA and the impact of running on cartilage is not well understood. This study summarises the immediate impact of running on cartilage in healthy adults and those with, or at risk of OA, using magnetic resonance imaging (MRI) measures. Secondarily we explored the delayed impact of running on hip and knee cartilage, regional differences within each joint and associations with sex, run duration and age.

Methods: This study was a systematic review of six databases, with random-effects meta-analyses of studies that used MRI and a within-subject study design to measure change in hip or knee cartilage within 48 hours pre- and post-running. Risk of bias was assessed with the Newcastle-Ottawa Scale and certainty of evidence evaluated using the GRADE assessment.

Results: Twenty-four studies were included, evaluating 389 healthy knees and 57 knees with/at risk of OA (and no hips) in 378 participants (41% female). Participants were generally healthy, young adults (mean age 32 years, BMI 23kg/m^2). Thirty-three percent of studies were assessed low risk of bias. Decreases in knee cartilage morphology (thickness/volume) and composition (quality) occurred immediately after running and were greatest in the patellofemoral compartment. Morphology changes ranged from a loss of patellar cartilage volume of 5.5% (95%CI 4.4-5.7%) to a loss of weight-bearing femoral cartilage thickness of 2.8% (1.9-3.7%). Tibiofemoral composition measures (T2 relaxation times) recovered to baseline levels within 90 minutes, and existing cartilage defects were not altered within 48 hours after run completion.

Discussion: There is very low certainty evidence that running immediately decreases the thickness, volume and composition of patellofemoral and tibiofemoral cartilage. These findings support the biphasic model of a hydrostatic cartilage response to loading with redistribution and exudation of small amounts of water. Immediately after running, T2 relaxation times reduced, consistent with expected water loss and matrix consolidation in healthy cartilage. Cartilage composition changes returned to baseline within 60-90 minutes of run completion and morphology (volume/thickness) was reported to recover from 15 minutes-12 hours after running. There are no relationships between cartilage changes after running and age or sex although a trend was noted that indicated increased relaxation time reductions with increased run duration.

Impact:

- A single bout of running causes small, transient changes in cartilage and is not bad for the knees of healthy, young adults.
- Running can be promoted as a public health physical activity endeavour knowing that it doesn't appear to immediately alter joint structure detrimentally.

My co-authors and I acknowledge that we have no conflict of interest of relevance to the submission of this abstract.

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